CHAPTER VI - NAVENVPREDRSCHFAC TROPICAL CYCLONE SUPPORT SUMMARY

The Advanced Tropical Cyclone Model (ATCM)

(Hodur, R.M., NAVENVPREDRSCHFAC)

The Advanced Tropical Cyclone Model (ATCM) is being developed to improve forecasts of tropical cyclone paths to 72-hours. The ATCM is really the Navy Operational Regional Atmospheric Prediction System (NORAPS) redesigned to run optionally as a tropical cyclone model. Given this redesign, NORAPS can produce forecasts each watch for a given region, such as the tropical western Pacific, and if the ATCM option is included, any and all, tropical storms present in the forecast domain will be bogused into the initial fields. The forecast storm position(s) will be computed in the model at some selected interval and sent to JTWC upon completion of the forecast. Forecast fields (e.g., sea-level pressure, mean Planetary Boundary Layer (PBL) winds) can be sent also, as is currently done for all NORAPS areas.

Although the redesign of NORAPS to function as the ATCM is complete, the exact method of bogusing the tropical storm has not yet been determined. Currently, four methods of bogusing the tropical storm are being evaluated. Other tests are being conducted to evaluate the significance of interactions between storms which occur in multiple storm situations. Upon completion of these tests, the bogusing method which produces the smallest forecast errors will be incorporated into the ATCM and the system will be ready for operational evaluation.

Tropical Cyclone Prediction Research

(Elsberry, R.L. and J.E. Peak, NAVPOSTGRADSCH)

In view of high personnel turnover of the JTWC forecasters, more objective approaches to the tropical cyclone forecasting processes are being developed. The performance of different tropical cyclone forecast aids (NTCM, OTCM, RECR, TOTL, CY50) for various cyclone characteristics and different environmental conditions has been evaluated. The factors affecting the accuracy of objective forecast aids are being incorporated into a decision tree to assist the forecaster in following a logical and reasonable path in selecting the appropriate aid in a given situation. A post-processing scheme for adjusting the OTCM predictions, which achieved a 30% reduction in 72-hour forecast error on the dependent sample is proposed for operational testing. An objective method for determining the warning position from a variety of fixes has been given to NEPRF for testing.
would be unwarranted at lower risk levels. A rule for deciding such actions can be derived on an expected outcome basis (e.g. cost/benefits ratio). The CHARM model is now being adapted for seven North Pacific sites: Pearl Harbor, Guam, Subic Bay, Buckner Bay, Yokosuka, Sasebo, and Pusan.

Evaluation Of JTWC Objective Aids

(Tsui, T.L., and R.J. Miller, NAVENVPREDRSCHFAC)

The objective aid forecasts used at the Joint Typhoon Warning Center (JTWC) during the 1978-85 period are evaluated. Forecast accuracy is judged on error measures of forecast error, cross-track error, and along-track error. The evaluation includes the consistency, as well as the accuracy, of the objective aid forecasts. In addition, the data are stratified according to season, maximum storm intensity, and storm path type for a more detailed error analysis. During the first eight-year period (1978-85), HPAC, the climatology/persistence model, and OTCM, a dynamical model, emerged as the best and most consistent aids.

Results also show that the forecasters at JTWC can assimilate the wealth of objective aids and provide reliable forecast guidance. When storms move erratically or fail to attain typhoon strength, JTWC forecasts are superior than the objective aids.

Automated Tropical Cyclone Forecasting System

(Miller, R.J., and T.L. Tsui, NAVENVPREDRSCHFAC)

The Automated Tropical Cyclone Forecasting (ATCF) system is an IBM PC compatible software package currently being developed for the Joint Typhoon Warning Center (JTWC). ATCF is designed to allow JTWC forecasters to display graphically tropical cyclone forecast information, merge and analyze synoptic wind fields, provide objective fix guidance, select optimum objective forecast aid, and expedite the issuance of tropical cyclone warnings. One great advantage of using ATCF is the standardization of the tropical cyclone forecasting procedures, so that during the course of the tropical cyclone warning preparation, forecasters will not neglect consideration of any
decisional steps or available options. ATCF automatically saves all tropical cyclone data, computes the real-time and post-storm statistics, and allows forecasters to randomly access any past storm data. A communication package included in ATCF simplifies the data transfer procedure between JTWC and Fleet Numerical Oceanography Center in Monterey, California.

When the ATCF is fully developed, it can be used as a training aid to simulate the actual Tropical Cyclone Inner Regional Circulation Classification

(Gray, W.M, Colorado State University)

The goals of the project are 1) to analyze the details of inner 270 nm (500 km) radial and vertical structure of tropical cyclones of the western North Pacific, and 2) to determine the various classes of inner region circulations. The results are expected to assist in determining the proper inner core circulation bogusing method in the initialization procedure of the new Advanced Tropical Cyclone Model.

Aircraft reconnaissance data will be used for knowledge of the inner 150 nm (278 km) radius cyclone circulation at lower tropospheric levels. Rawinsonde and Japanese Geostationary Meteorological Satellite (GMS) satellite data will be used for information on the circulation characteristics (with some overlapping) between 150-270 nm (278-500 km) radii and for estimates of the vertical resolution of the

cyclone circulation at all radii. It is anticipated that there are four or five distinctive inner cyclone circulation patterns which need to be documented for analytic incorporation into the numerical model.

Navy Tactical Applications Guide (NTAG), Vol. 6

(Fett, R.W., NAVENVPREDRSCHFAC)

An effort is now underway to develop a series of examples demonstrating the use of high quality satellite data for analysis and forecasting in the tropics. Both polar orbiter and geostationary satellite data are used to study the evolution of certain weather effects or of a particular weather phenomenon at a given time.

These examples are intended for publishing in the NTAG volume 6, Part I, Tropical Weather Analysis and Forecast Applications, and Volume 6, Part II, Tropical Cyclone Weather Analysis and Forecast Applications. NTAG Volume 6, Part I is presently in the publishing process. Distribution is anticipated in early 1987. Part II is still in the research process. Publication is anticipated in 1988/89.

Tropical Cyclone Condition Setting Aid

(Jarrell, J.D., Sci. Appl. International Corporation)

The tropical cyclone wind probabilities formed the basis for the development of a model to aid in threat analysis and decision making. The Cyclone Hurricane Acceptable Risk Model (CHARM) developed by Jarrell assumes that at some high risk or high probability level, decision makers would order tropical cyclone condition evasion actions that tropical cyclone warning procedure. New forecasters can gather valuable hands-on experience of the warning procedure during their training period.

North Pacific Tropical Cyclone Climatology

(Miller, R.J. and T.L. Tsui, NAVENVPREDRSCHFAC)

A tropical cyclone climatology for the North Pacific has been developed and now is being reviewed by EGPACOM. Data used for the western basin were taken from the JTWC tropical cyclone data base and covered a period of 40 years, 1945-84. Eastern basin data spanned the 34 years period 1949-82 and were obtained from the consolidated world-wide tropical cyclone data base at National Climatic Data Center, Asheville, N.C.

Storms for both basins were sorted according to month/day of the year into twenty four 31-day overlapping periods. For each period, four charts are supplied: 1) actual storm paths; 2) mean storm paths 3) average storm speed; and 4) storm constancy and frequency.

Evaluation Of CSUM Objective Aid

(Tsui, T.L. and R.J. Miller, NAVENVPREDRSCHFAC)

CSUM is a statistical tropical cyclone prediction model developed by Matsumoto and Gray (Colorado State University), and was implemented into the JTWC combined ARQ procedure in September 1985. Preliminary results of all 35 storms since implementation indicate that CSUM gives good objective guidance. The mean 72-hour forecast error for CSUM was 303 nm (561 km) compared to 315 nm (583 km) and 330 nm (611 km) for COSMOS and OTCM respectively for the same period. In a head-to-head comparison, CSUM had a lower mean error than all other objective aids. The median 72-hour cross-track and along-track errors indicate that CSUM possesses no track bias but is one of the slower techniques in terms of predicted storm speed.